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Thesis

A SURVEY TO DETERMINE TO WHAT EXTENT USELESS PROCESSES IN ARITHMETIC ARE BEING TAUGHT IN THE SCHOOL SYSTEMS OF MAINE

Submitted by

Warren Gardiner Hill

(B.S. in El. Ed., Gorham Normal School, 1939)

In partial fulfillment of requirements for the degree of Master of Education

1941

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Grateful acknowledgement is made to Mrs. Gladys Patrick, Field Agent for Rural Education, State of Maine, for her aid in securing the data upon which this study is based.

CHAPTER I

INTRODUCTION

A. Historical background of arithmetic in North America

Sixty-four years after Columbus knelt down and kissed the soil of the New World, an arithmetic book was published in North America. 1/ This book, "The Sumario of Brother Juan Diez," was written by a follower of Cortez and printed on a press which had been established for nineteen years.

This historical work was composed of 103 folios. It contained a very elaborate system of tables; moneys, rates of exchange, per cents, and "other monetary affairs of various kinds." 2/ There were twenty-four pages of mathematical text, eighteen of which were arithmetic and six, algebra. The arithmetic was of two types: First, problems dealing with the tables given, and, second theory of numbers. The following is an example of the second type...Give me a number which, increased by fifteen is a square number; and decreased by four is a square number also. The answer was given, as well as the rule which solved it. The rule was rather complicated, having

1/ Smith, D.E., History of Mathematics, I, Ginn & Co., Boston 1923; pg. 353
2/ Ibid., pg. 1

five steps. The five steps are here presented in their mathematical form.

1. $15 + 4 = 19$
2. $19 + 1 = 20$
3. $20 \div 2 = 10$
4. $10 \times 10 = 100$
5. $100 - 5 = 85$

No reason was given for employing this method and no rule was made to follow for similar problems.

Leaving the contribution of Brother Juan Diez as an interesting bit of the History of Mathematics, we turn now to the schools established in the early colonies and examine the place of arithmetic in their curricula. Sadly in the minority were the schools that attempted arithmetic instruction in any form. Latin was the key subject and vitally necessary as a preparation for college, where texts and even lectures were in Latin. Arithmetic was not required for college entrance, so it did not share the spotlight with Caesar.

The study of the place of arithmetic in the elementary school curriculum can be readily divided into periods.1/ The first of these is termed the Colonial Period and extends from 1620-1821. At this time the medium of exchange was largely barter, and many different species of money exchanged hands. The business men of the day found that a knowledge of arithmetic was necessary to their success. Through this felt need,

1/ Wilson, Stone and Dalrymple, Teaching the New Arithmetic, McGraw-Hill Book Co., New York, 1939, pg. 46

arithmetic fought its way into the elementary school curriculum. The outstanding text was Thomas Dilworth's "School Master's Assistant" which was published in England, as were the majority of texts prior to 1800. In countless cases, the teacher possessed the only text, and the entire school "copied" from it.1/

The first arithmetic written in America was the result of the efforts of Isaac Greenwood and bore the following title: "Arithmetic, Vulgar and Decimal, with the application thereof to a variety of cases in Trade and Commerce by Isaac Greenwood M.A. and P.M. for T. Hancock at the sign of the Bible and Three Crows in Ann Street MDCCXXIX." 2/

Greenwood's contribution was superceded by that of Nicholas Pike in 1778. This book was the unchallenged authority for over fifty years. It was entitled "A New and Compleat Arithmetic for Citizens of the U.S." and included all the arithmetic to date. It was considered "too comprehensive and complex" for the "average scholar." Of its 512 pages, 408 were devoted to arithmetic, 60 to plane geometry, trigonometry and mensuration, 33 to algebra and 10 in introducing conic sections. Leather bound, $2.50. A typical excerpt from Pike's arithmetic is the following table: 3/

1/ Magruder, Mary, "Early Textbooks in Arithmetic," N.E.A. Journal, Vol. XIV, pg. 275
2/ Ibid., pg. 3
3/ Ibid., pg. 3

2 pints	1 quart
2 quarts	1 pottle
2 pottles	1 gallon
2 gallons	1 peck
4 pecks	1 bushel
2 bushels	1 strike
2 strikes	1 coom
2 cooms	1 quarter
4 quarters	1 chaldron
4½ quarters	1 chaldron (in London)
5 quarters	1 wey
2 weys	1 last

This was but one of many tables that children were required to memorize verbatim, as a part of a liberal education.

The first, or Colonial, Period merged into the second which extended from 1821-1890, and was colored by the philosophy of Pestalozzi. The writers of this period were Colburn, Greenleaf, Davies, Ray, Perkins, Thomson, Stoddard and Brooks - notably Colburn. "He modified the problem work, omitted the rule in processes, and attempted to use the inductive method of approach.1/" Colburn was among the first to endeavor to lighten the load in the arithmetic curriculum. He was also an early exponent of the theory of mental discipline as the following quotation from his works clearly points out: "Arithmetic properly taught is acknowledged by all to be very important as a discipline of the mind.....This is a very important consideration though a secondary one as compared with its practical value."2/

1/ Monroe, W.S. "Development of Arithmetic as a School Subject" U.S. Bureau of Education, Bulletin 10, 1917, pg. 85
2/ Magruder Op. cit. page 276

The practical value was promptly forgotten. "Welcomed into the schools as a subject that would furnish a useful tool, we find arithmetic promptly formalized and later defended on a basis of formal discipline."1/ The spirit of the times is caught in a quotation used by Magruder, the author not being given. It is a perfect gem -- "When properly taught, it (arithmetic) gives quickness of perception, keenness of insight, toughness of mental fibre and an intellectual power and grasp that can be acquired by no other elementary branch of study." Teachers accepted this view as a justification of an over formalized subject. It is not surprising that they devoted a major part of the school day to arithmetic. A child was promoted, not on a basis of natural ability, but on how far he had progressed in the book. From the scholar's viewpoint, arithmetic was an endless science, of which only a minor part could be mastered in their school life. Warren Burton describes it well.2/ "At the age of twelve, I commenced the study of arithmetic, that chiefest of studies in Yankee estimation. The entering on arithmetic was quite an era in my schoolboy life. This was placing me decidedly among the great boys and within hailing distance of manhood. My feelings were consequently considerably elevated. A new Adam's Arithmetic of the latest edition was bought for my use. It

1/ Smith, D.E., Op. cit. page 14
2/ Burton, Warren, The District School As It Was, Thomas Y. Crowell Co., 1928, pg. 110

was covered by the maternal hand with stout sheepskin, in the economical expectation, that, after I had done with it, it might help still younger heads to the golden science. A quire of foolscap was made to take the form of the manuscript of the full length of the sheet, with a pasteboard cover, as more suitable to the dignity of such superior dimensions than flimsy brown paper.....I advanced as far as reduction this first winter.....The next winter I began at addition again to advance just through interest. My third season I went over the same ground again and, besides that, ciphered to the very last sum in the rule of three. This was deemed quite an achievement for a lad only fourteen years old."

The very name of Colburn's book helped to defeat his reform purpose--"First Lessons in Arithmetic on the plan of Pestalozzi, a mental Arithmetic." He did substitute in the lower grades problems orally given for ciphering often without any understanding of the work.

The third period is much shorter. Termed the "Reflective Period," it extends from 1890-1911. In this period, leading educators in the elementary field questioned the practicability of teaching arithmetic as it was then being taught. These men, influenced by the teachings of Herbart and William James, met with stern opposition. The advocates of the existing system called forth many argumentative proofs of its validity. Overman presents one. "In order to defend the

teaching of so much useless and obsolete material, educators called to their aid the psychological doctrine of formal discipline.....Under such a doctrine it would make very little difference what is taught, just so it is not too easy."1/ In this period the defenders of the theory of mental discipline carried the day. They discredited the report of the Committee of Ten as much as they could and clung tenaciously to their own erronious beliefs.

The fourth and final period extends from 1911 till the present. Dalrymple labels it the "Survey of Social Usage Period."2/ The new force operating during the period is the survey of the social and business usage of arithmetic or in other words, careful studies of adult usage of arithmetic. These surveys were carried out scientifically and yielded valid results. They were a far cry from the arguments propounded by their opponents. Wilson, Wise, Woody, Bobbitt, Thorndike, Charters, Patton, D. Wilson, Buckley, Lindberg, Dalrymple, and others made surveys of social and business usage of arithmetic. Their findings were in practically complete accord. They found that the arithmetic used in everyday life and business situations is comparatively simple, ninety percent of which is made up of the four fundamental processes and simple fractions alone. On this

1/ Overman, J.R., Principles and Methods of Teaching Arithmetic, Lyons and Carnahan, Chicago, 1920, pg. 7
2/ Wilson, Stone and Dalrymple, Teaching the New Arithmetic McGraw-Hill Book Co., New York, 1939, page 46

basis, it was agreed by these educators that the arithmetic drill load should be cut down, and that the numerous and difficult processes should be taught only as appreciation or informational units.

Brown summarizes Wilson's findings which are both pioneer and typical in the following quotation.1/ "The investigations made by Wilson to determine the kinds of arithmetic problems which are used in social and business activities is illuminating. From a list of problems carefully collected from more than four thousand people through tabulations made by the (school) children, of all the arithmetic problems which they had to solve for a period of two weeks, it became evident that the majority of adults use arithmetic only when something is bought or sold or when some measurement is necessary. Wilson found that, when the problems were analyzed, with respect to the arithmetic processes involved, addition with 20.1%, subtraction with 12.9%, multiplication with 31.8%, division with 11.1%, fractions with 9.0% and simple accounts with 5.5% constituted more than 90% of all the processes used. Most of the remaining processes in the occupations which were studied intensively closely follow the relative frequency of their use in all occupations. The problems which occurred in actual situations were characterized by their simplicity. Only 72 of the 4416 addition prob-

1/ Brown, J.C., A Summary of Some Significant Conclusions Reached by Investigators Relative to Arithmetic. Elementary Sch. Journal, Vol. XXV, pg. 353

lems involved more than four place numbers; very few problems in subtraction involved more than four places, of the 6974 multiplication problems only 53 had four place multiplicands; 2437 problems in division included only 102 problems with four place divisors and only one with a five place divisor. About one-eighth of the problems involved fractions, and the fraction 1/2 made up nearly two-thirds of the total number of fractions used."

There is but one justification for the teaching of arithmetic upon a drill basis -- Use in Life. "There is no other subject, except in the use of the mother tongue, which is so intimately connected with everyday life, and so necessary to the successful conduct of affairs."1/

B. The Problem

The problem herein studied is that of discovering the extent to which the social utility concept for the selection of drill material in the field of arithmetic has infiltrated a definite geographical area in the United States, namely, the State of Maine.

C. Need for the study

The need for this study was not fully, or even well, known when it was begun. It has been a fact finding study. The writer knew enough about practices in the schools of Maine to raise the question. His desire to know more was supported

1/ Young, J.W.A., The Teaching of Mathematics, Longmans Green & Co., New York. Revised, 1920; pg. 13.

and encouraged by his advisors and by members of the staff in the offices of the State Department of Education for Maine. Textbooks in use supported the suspicion that much of the time which children devoted to arithmetic was being placed on useless or little used topics. The returns indicate that such a study was needed, and if heeded, may result in definite changes for the better.

CHAPTER II

PROCEDURE

A. Choice of the state of Maine

The State of Maine was chosen because no similar study has been made in the state. The state course of study includes processes which might be termed useless,[1] and the State Department of Education was anxious to discover to what extent arithmetic processes were actually being taught in their schools.

B. Random sampling of teachers in the state

This matter was left to the discretion of Mrs. Gladys Patrick, Field Agent for Rural Education in the State of Maine. She suggested a sampling of one hundred schools, located in all parts of the state,[2] and ranging from the smallest rural school to one of over five hundred pupils.

C. Preparation of questionnaire

The questionnaire consists of twenty seven processes in arithmetic. The fundamentals were included of necessity and the other processes were chosen at random from prepared

---

1/ Wilson, What Arithmetic Shall We Teach, Houghton Mifflin Co., 1926, pg. 11

2/ See distribution map, pg. 19.

lists of useful and useless processes. 1/ These were classified under five headings 2/ (1) Fundamental Processes, (2) Fractions, (3) Tables and Measures, (4) Business Arithmetic, and (5) Miscellaneous. No attempt has been made to discriminate between useful and useless processes under any heading.

The questionnaire has convenient spaces for the person checking to indicate which processes he is teaching, in what grades, and the amount of time he is spending on each. If a process other than any of these twenty-seven is being taught, it is to be listed in the space provided at the bottom of the questionnaire. The source of information is very important, so the person checking was asked to give his name and the name of the school in which he is teaching.

D. Distribution of the questionnaire

The questionnaire was distributed through the cooperation of the Maine State Department of Education. Questionnaires were sent to one hundred teachers in the state, picked at random by the state department. The hundred teachers represent schools in the largest cities and the smallest towns. (See distribution map, pg. 19). Some teach in a single grade, some in all grades and others in departmentalized schools. (See Teacher Placement chart, pg. 23). Returns were received from seventy-eight of the one hundred teachers to whom ques-

1/ See page 11, reference 1.
2/ These follow closely the major headings of processes discussed in leading textbooks in arithmetic.

tionnaires were sent.

The questionnaire and accompanying letter forms follow herewith.

Augusta
Maine
February 24, 1941

I am interested in collecting a little information on the amount of time spent on arithmetic and what material we are really teaching. I have selected you as one of the teachers capable of telling me. Would you please check on the enclosed sheet, as directed, the processes you are teaching and the amount of time spent on each. Please do not feel that each process should be checked. Some are included just in case they are being taught as drill material.

It would help if you could do this for me some time during the week.

Yours truly,

Mrs. Gladys Patrick
Field Agent for Rural Education.

Process	Check (✓) if taught as drill subject	Grades	Time in hours
Fundamental Processes	**********	*******	********
a. Addition			
b. Subtraction			
c. Multiplication			
d. Division			
Fractions	**********	*******	********
a. Common			
b. Improper			
c. Compound			
d. Cancellation			
e. G.C.D.			
Tables and Measures	**********	*******	********
a. Avoirdupois Weight			
b. Troy Weight			
c. Foreign Money			
d. Metric System			
e. Longitude and Time			
Business Arithmetic	**********	*******	********
a. Decimals			
b. Accounts			
c. Partnership			
d. Partial Payments			
e. Case 3 in %			
f. Compound Interest			
g. Annual Interest			
h. True Discount			
Miscellaneous	**********	*******	********
a. Counting			
b. Square Root			
c. Cube Root			
d. Compound Numbers			
e. Mensuration			
Other Processes	**********	*******	********
a.			
b.			
c.			

.....

(Illustration)			
Square Root	✓	7-8	10

Filled in by _____

Name of School _____

Number of Pupils _____

Number of weeks of school _____

THESE DATA ARE FOR STATISTICAL PURPOSES ONLY --
YOUR NAME WILL NOT BE USED IN ANY WAY

E. The Returns

One hundred questionnaires, accompanied by letters and addressed return envelopes were sent. Seventy-eight were returned. No follow-up letters were sent.

This is an unusually high percentage (78%) for first returns and indicates a high degree of interest in the study. A previous research student has indicated that where there is no reward for answering, returns of even 5.2% are satisfactory.[1/]

A further indication of interest in the study is the large number of requests for a summary of the completed investigation.

F. Classification of data

Data were first reduced to a single grade basis, i.e., if a rural teacher reported eight grades on a single questionnaire, this material was transferred to eight individual questionnaires, thus facilitating the classification of data by grades. The information obtained for each grade is as follows:

(1) Number of teachers reporting for that grade.

(2) Number of teachers reporting the teaching of each process.

(3) Percentage of teachers reporting the teaching of each process.

(4) Mean time in hours per year for each process.

(5) Median time in hours per year for each process.

1/ Kenman, Richard B.,"Private Correspondence School Enrollee," Teacher's College Contributions to Education, Vol. 796, Pub. 1940, pg. 9.

(6) Percentage of entire arithmetic time given to each process. (Based on Mean)

(7) Percentage of entire arithmetic time given to each process. (Based on Median)

G. Summary tables constructed and conclusions drawn

Two summary tables were constructed showing the percentage of time spent on each process in each grade. 1/ One being based on the mean, the other on the median, thus showing the outstanding process or processes (from a time point of view) for each grade.

After summary tables had been constructed, general conclusions and recommendations 2/ were drawn.

1/ See tables IX and X, pg.
2/ See pg. 54.

CHAPTER III

DATA

A. Spread

1. Geographically

The geographical distribution map on page 19 shows to what extent the random sampling covered the state. It is to be interpreted in the following manner: A circle has been placed on the map for each town to which a questionnaire was sent. If a reply was received from that town, the circle has been filled in with red.

There is no county which is not represented. The most thickly populated region in the state lies between the seacoast and the head of navigation on the rivers. A greater number of questionnaires were sent, therefore, to this region than to the more sparsely populated regions of the state.

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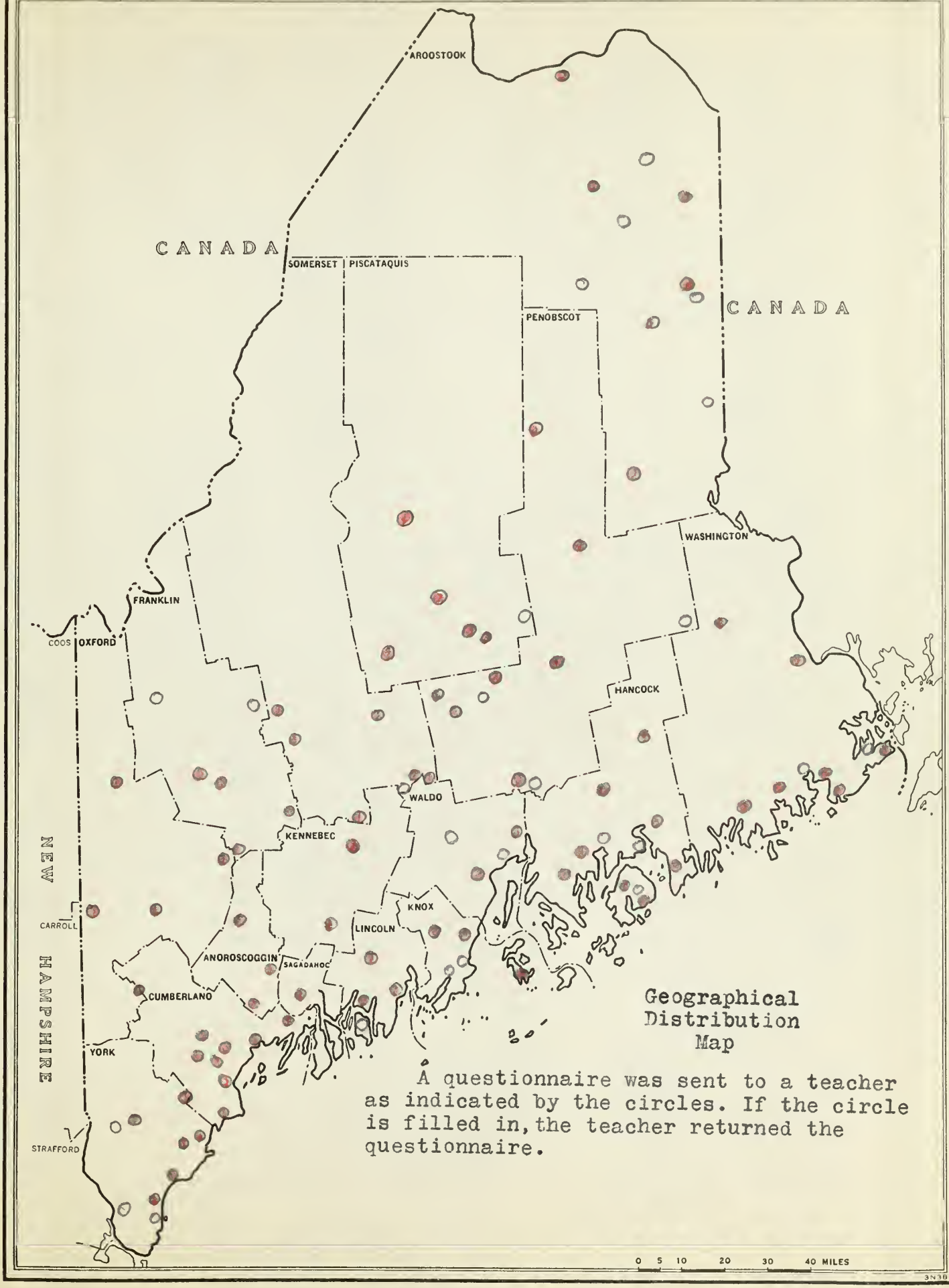

Geographical Distribution Map

A questionnaire was sent to a teacher as indicated by the circles. If the circle is filled in, the teacher returned the questionnaire.

2. By grades

Table I shows the grades in which the seventy-eight teachers who reported are teaching. The table is to be read as follows: One sub-primary teacher reported, six first grade teachers reported, seven second grade teachers reported; six teachers reported who are teaching grades three and four; three teachers reported who are teaching grades four through eight; eleven rural school teachers reported, etc.

Table I. Showing the grades taught by teachers answering questionnaire.

Sub-primary	1
Grade I	6
Grade II	7
Grade III	2
Grade IV	7
Grade V	6
Grade VI	3
Grade VII	2
Grade VIII	2
Sub-primary & Grade I	1
Grades 1 & II	1
Grades I to III	1
Grades II & III	2
Grades III & IV	6
Grades III to V	1
Grades IV & V	2
Grades IV to VI	1
Grades IV & V, VII & VIII	1
Grades IV to VIII	3
Grades V & VI	2
Grades V to VIII	1
Grades VII & VIII	4
Grades VII to IX	1
Rural	15
	78

Figure 1 shows teacher placement from the viewpoint of the number of grades taught by each teacher. It is to be read as follows: Thirty-six of the seventy-eight teachers reporting teach in a single grade, eighteen teach in two grades, etc. The classification "Rural" represents teaching eight grades. In each instance, the percentage of the total is given, i.e., twenty-three percent of all teachers reporting teach in two grades, nineteen percent teach in rural schools, etc.

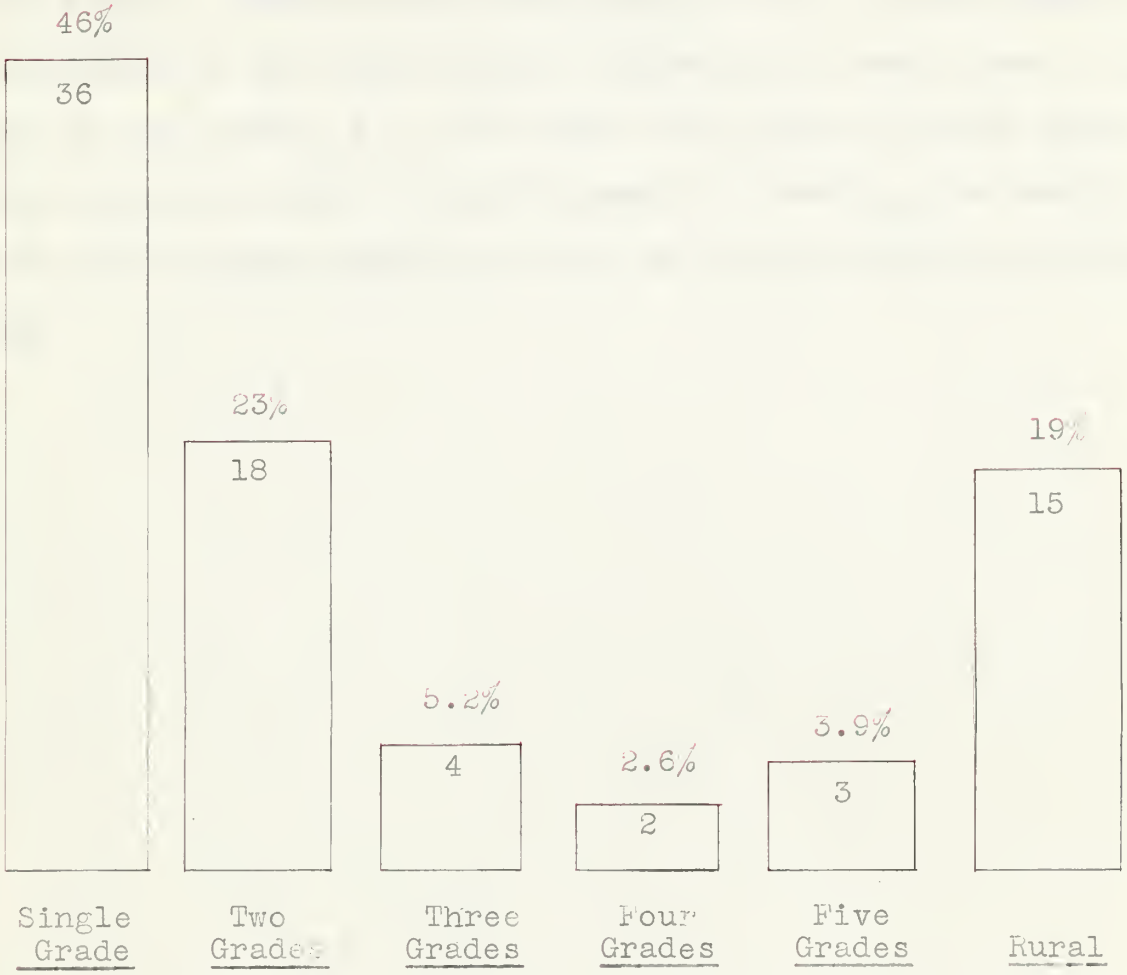

Figure 1. Showing graphically the number of grades in the rooms of the teachers answering the questionnaire.

Figure 2 shows the number of grades reporting. It is to be read as follows: Reports were received from three sub-primary grades, twenty-four first grades, twenty-six second grades, twenty-seven third grades, etc. In each case the percentage of the total number reporting has been given at the top of the column, i.e., the three sub-primary grades reporting represent 1.34% of all the grades reporting, the twenty-four first grades represent 10.7% of all the grades reporting, etc.

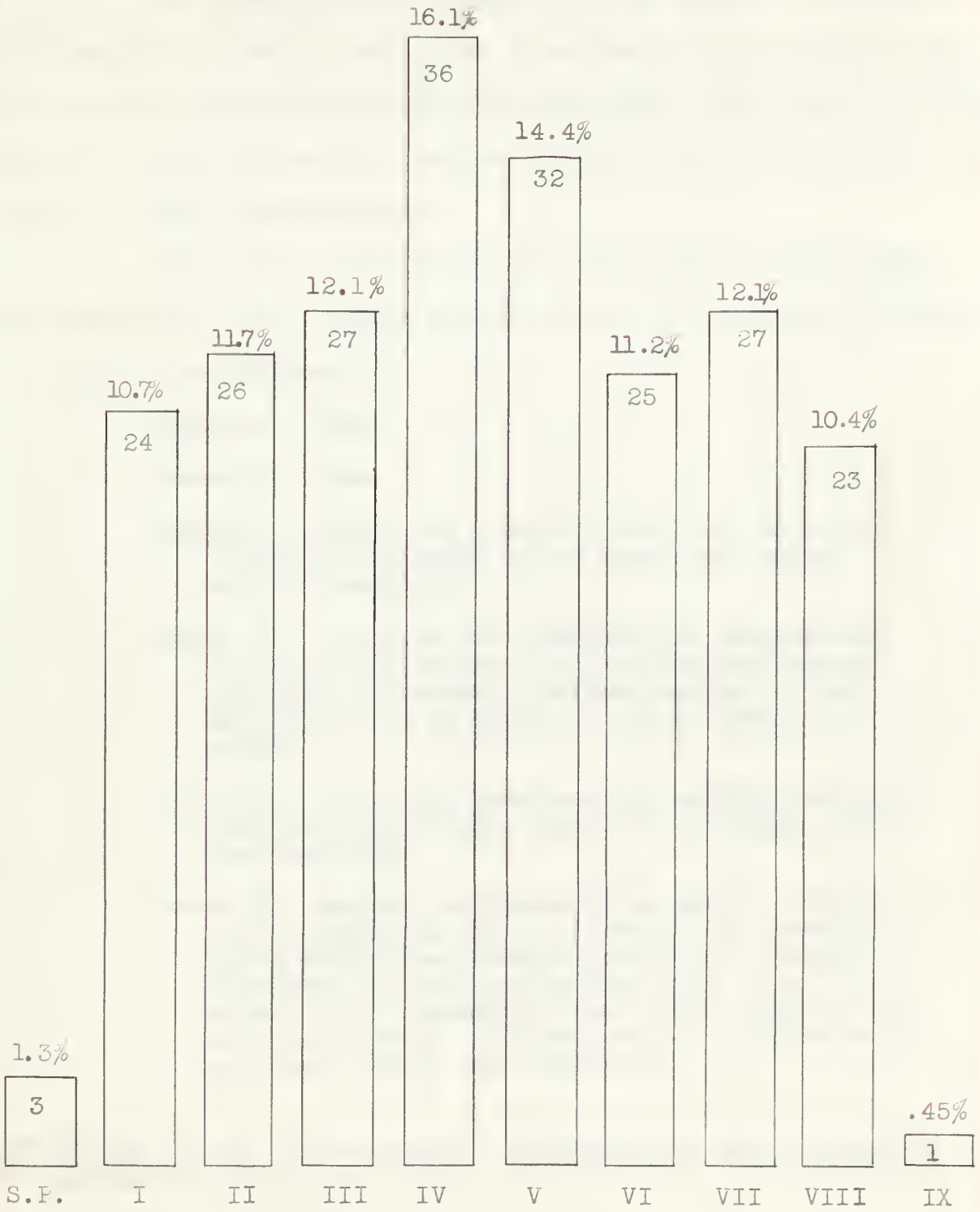

Figure 2. Showing the numbers and percentages for each grade of the total of 224 grade returns.

B. Interpretation

It is the stated purpose of this paper to compare critically the drill curriculum in arithmetic as advocated by the social utility theorists with the drill curriculum in arithmetic as reported by the teachers in the State of Maine who replied to this questionnaire.

The social utility drill curriculum for arithmetic as advanced by one leading text 1/ in the field is as follows:

Drill (in arithmetic)

Grade 1. None

Grade 2. None

Grade 3. Addition, possibly subtraction also, completely covered as to facts and steps, perfect mastery.

Grade 4. Addition and subtraction checked and taught as necessary. Multiplication added, complete coverage, perfect mastery. Short division as a reverse of multiplication, if taught.

Grade 5. Addition, subtraction, multiplication. Long division added, complete coverage, perfect mastery.

Grade 6. Review and reteach the above, according to pupil needs, as revealed by inventory tests that give complete coverage. Simple fractions as the new process, but only on an objective, nonmanipulative basis, applied to halves, fourths, thirds, and, in special situations, eights and twelfths.

1/ Wilson, Stone and Dalrymple, Teaching the New Arithmetic, McGraw Hill Book Co., 1939.

Grade 7. Thorough check on individual needs in the fundamentals, reteach as needed. Percentage and interest as the new process.

Grade 8. No new drill processes. But in the average school today, less than 20 per cent of pupils are letter perfect in the simple fundamentals. These should receive first consideration.

The data for the sub-primary and Grade IX have been excluded. It is felt that tenable conclusions could not be drawn on the number of reports received from teachers in these grades, i.e., reports were received from three sub-primary teachers and from one ninth grade teacher.1/

Grade I. The findings for Grade I are to be found in Table II on page 29. Table II indicates to what extent actual practice in arithmetic drill in arithmetic in the state of Maine lags behind that which is advocated by the social utility theory. The social utility theorists burden the child with no drill whatsoever in Grade I. The actual findings indicate that nine different processes are drilled upon in this grade. The emphasis is definitely upon addition and subtraction. 100 per cent of the teachers reporting for Grade I have indicated that they are giving drill time in arithmetic to addition, with a mean time of 42.1 hours per year spent upon it. The smallest amount of time reported was 15 hours per year and the greatest 88 hours per year. Subtraction was reported as being taught by 90 per cent of these teachers, with a mean time of 41.7 hours

1/ See Figure 2, pg. 23.

per year. In the case of subtraction, the range was from 15 to 90 hours per year.

The other processes reported as receiving drill time in Grade I were multiplication, division, common fractions, avoirdupois weight, longitude and time, counting, and mensuration. It is undoubtedly true that those teachers who reported the teaching of longitude and time were in reality teaching telling time. This is true throughout the lower grades. The one case reported in mensuration was probably due to another misinterpretation. This teacher may have been teaching the measurement of linear distances. The two cases under common fractions are interpreted as informational work, and not as manipulation.

Table II

Summarizing the Questionnaire Data for Grade I

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Process	No. Reporting for the Gr.	No. Tchg. Partic. Process	Per cent Tchg. Process	Range in Hrs. per Yr.	Mean Time in Hrs. per Yr.	Col.6 reduced to per cent of Total	Median Time in Hrs. per Yr.	Col.8 reduced to per cent of Total
Fundamental Processes								
a. Addition	19	19	100	15-88	42.1	18.9	40	22.4
b. Subtraction	19	17	90	15-90	41.7	18.6	40	22.4
c. Multiplication	19	3	16	15-90	44	19.7	27	16.6
d. Division	19	2	11	9-15	12	5.4	12	6.2
Fractions								
a. Common	19	2	11	9-15	12	5.4	12	6.2
b. Improper								
c. Compound								
d. Cancellation								
e. G.C.D.								
Tables and Measures								
a. Avoirdupois Weight	19	1	5	-15	15	6.7	15	9.2
b. Troy Weight								
c. Foreign Money								
d. Metric System								
e. Longitude and Time	19	2	11	4-20	12	5.4	12	6.2
Business Arithmetic								
a. Decimals								
b. Accounts								
c. Partnership								
d. Partial Payments								
e. Case 3 in %								
f. Compound Interest								
g. Annual Interest								
h. True Discount								
Miscellaneous								
a. Counting	19	4	21	3-54	20.3	9.1	12	6.2
b. Square Root								
c. Cube Root								
d. Compound Numbers								
e. Mensuration	19	1	5	-5	5	2.3	5	3.1

Grade II. The findings for Grade II (See Table III) were not so far removed from the social utility ideal as were those of Grade I. The simplified functional curriculum of the social utility theorists advocates no drill on any process in Grade II. Actually, drill on seven different processes were reported. Again, as in Grade I, the emphasis is on addition and subtraction. 100 per cent of the teachers reporting indicate that they are teaching addition upon a drill basis. The mean amount of time in hours per year which is given to drill in addition is 67.8, which is greater by 25 hours per year than the mean time for addition in Grade I.

91 per cent of the teachers reporting indicate that they are teaching subtraction upon a drill basis, and spending a mean time of 60.3 hours per year upon it. This is an increase of 18 hours per year over that reported in Grade I.

The range in both addition and subtraction is much greater in Grade II than in Grade I, addition ranging from 15 to 198 hours per year and subtraction from 15 to 175.

The five additional processes reported as receiving drill were multiplication, division, longitude and time, counting and mensuration. Multiplication and counting were each reported in four cases. These are not negligible factors, as the range in multiplication indicates that at least one teacher is giving 90 hours per year to the process. Ninety hours a year of drill on multiplication in the second grade is a far cry

from no drill whatsoever. The four cases of counting have a mean time of 15 hours per year which is slightly more defensible. Division, longitude and Time, and mensuration are relegated to a minor position due to the fact that each was reported in but a single case. Reports on mensuration and longitude and time are probably due to the reasons given for their appearnace in Grade I. (See pg. 28).

Table III

Summarizing the Questionnaire data for Grade II

(1) Process	(2) No. Reporting for the Gr.	(3) No. Tchg. Partic. Process	(4) Per cent Tchg. Process	(5) Range in Hrs. per Yr.	(6) Mean Time in Hrs. per Yr.	(7) Col.6 reduced to per cent of Total	(8) Median Time in Hrs. per Yr.	(9) Col. 8 reduced to per cent of Total
Fundamental Processes								
a. Addition	22	22	100	15-198	67.8	25.2	60	26.4
b. Subtraction	22	20	91	15-175	60.3	25.3	56.5	24.9
c. Multiplication	22	4	18	21-90	48	20.2	40.5	17.8
d. Division	22	1	5	-45	45	19	45	19.3
Fractions								
a. Common								
b. Improper								
c. Compound								
d. Cancellation								
e. G.C.D.								
Tables and Measures								
a. Avoirdupois Weight								
b. Troy Weight								
c. Foreign Money								
d. Metric System								
e. Longitude and Time	22	1	5	-4	4.0	1.7	4	1.8
Business Arithmetic								
a. Decimals								
b. Accounts								
c. Partnership								
d. Partial Payments								
e. Case 3 in %								
f. Compound Interest								
g. Annual Interest								
h. True discount								
Miscellaneous								
a. Counting	22	4	18	3-30	15	6.4	12.5	5.5
b. Square Root								
c. Cube Root								
d. Compound Numbers								
e. Mensuration	22	1	5	-5	5	2.1	5	2.2

Grade III. In this grade, the social utility curriculum places the first drill, to be given to addition and possibly subtraction. Table IV, summarizing the reports received from teachers in Grade III, reveals that no such simple program is being carried out. Only 75 per cent of the teachers report drill on addition, and 79 per cent drill on subtraction. Compare with this the fact that 93 per cent are teaching multiplication and division and alloting a mean time of from 5 to 11 hours per year more time on them than on addition and subtraction. The emphasis in this grade has definitely swung away from addition and subtraction and settled on multiplication and division.

25 per cent of the teachers reporting indicate that they are giving drill time to avoirdupois weight, and 17 per cent report the teaching of common fractions. The percents for these two processes is higher in this grade than in the preceding ones and indicates the beginning of a swing away from the fundamentals.

Longitude and time, counting, and mensuration are reported in a small percentage of cases. (See table IV, pg.34).

Table IV

Summarizing the Questionnaire data for Grade III

(1) Process	(2) No. Reporting for the Gr.	(3) No. Tchg. Partic. Process	(4) Per cent Tchg. Process	(5) Range in Hrs. per Yr.	(6) Mean Time in Hrs. per Yr.	(7) Col.6 reduced to per cent of Total	(8) Median Time in Hrs. per Yr.	(9) Col.8 reduced to per cent of Total
Fundamental Processes								
a. Addition	24	18	75	12-99	34.2	14.1	30	19.7
b. Subtraction	24	19	79	12-144	34.1	14.1	30	19.7
c. Multiplication	24	22	93	12-100	45.9	19	36	21.3
d. Division	24	22	93	12-97	39.1	16.4	31	18.4
Fractions								
a. Common	24	4	17	5-12	7.5	3.1	6.5	3.9
b. Improper								
c. Compound								
d. Cancellation								
e. G.C.D.								
Tables and Measures								
a. Avoirdupois Weight	24	6	25	4-24	10.7	4.5	8.5	5
b. Troy Weight								
c. Foreign Money								
d. Metric System								
e. Longitude and Time	24	3	13	4-24	11	4.5	5	3
Business Arithmetic								
a. Decimals								
b. Accounts								
c. Partnership								
d. Partial Payments								
e. Case 3 in %								
f. Compound Interest								
g. Annual Interest								
h. True Discount								
Miscellaneous								
a. Counting	24	3	13	3-12	8.4	3.5	10	5.9
b. Square Root								
c. Cube Root								
d. Compound Numbers								
e. Mensuration	24	2	9	5-18	11.5	4.8	11.5	6.8

Grade IV. The curriculum for this grade (see Table V), as devised by the proponents of the social utility, would be a rechecking of addition and subtraction, the teaching of multiplication, and possibly the teaching of short division as a reverse of multiplication.

The actual reports for the grade reveal to us that a far more complex procedure is being followed. Fourteen processes are reported as receiving the available drill time, rather than the four advocated. The emphasis in Grade IV is, as in Grade III, upon multiplication and division. 97 per cent of the teachers reporting indicate that they are teaching these two processes. The amount of time given to each is not so great as in Grade III, due to the fact that the available drill time had to be meted out to so many other processes.

Addition and subtraction were reported as being taught by 94 per cent of the teachers of Grade IV, who answered the questionnaire. From this grade on, the time alloted to the fundamental processes is consistently less and less. This neglect comes at the very time when a thorough foundation for future work should be laid.

In this grade business arithmetic processes are reported as being drilled upon for the first time. Isolated cases of accounts and partnership were reported with 3 hours per year spent on each. These processes justify little or no drill in the upper grades, and surely not in Grade IV.

Cancellation and improper fractions are reported as being taught in isolated cases in this grade, in addition to common fractions. Again, the amount of time, 3 hours per year is negligible. Counting is reported as being taught by 29 per cent of the teachers answering the questionnaire.

Under Tables and Measures, 29 per cent of the teachers reporting for Grade IV indicate drill time being given to avoirdupois weight. There is an isolated case of Troy weight being taught, and two cases of longitude and time. Counting is reported by 10 per cent and mensuration by 16 per cent of all teachers reporting for the grade.

Table V

Summarizing the Questionnaire Data for Grade IV

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Process	No. Reporting for the Gr.	No. Tchg. Partic. Process	Per cent Tchg. Process	Range in Hrs. per Yr.	Mean Time in Hrs. per Yr.	Col.6 reduced to per cent of Total	Median Time in Hrs. per Yr.	Col.8 reduced to per cent of Total
Fundamental Processes								
a. Addition	31	23	74	7-60	20.3	11	20	12.1
b. Subtraction	31	23	74	9-90	26.2	14.2	27	16.4
c. Multiplication	31	30	97	12-90	38.5	20.9	36	21.8
d. Division	31	30	97	12-90	43.7	23.7	36	21.8
Fractions								
a. Common	31	9	29	2-50	6.2	3.3	8	4.9
b. Improper	31	1	3	-4	4	2.2	4	2.4
c. Compound								
d. Cancellation	31	1	3	-3	3	1.6	3	1.8
e. G.C.D.								
Tables and Measures								
a. Avoirdupois Weight	31	9	29	1-40	6.7	3.6	4	2.4
b. Troy Weight	31	1	3	-2	2	1.1	2	1.2
c. Foreign Money								
d. Metric System								
e. Longitude and Time	31	2	7	1-4	2.5	1.3	2.5	1.6
Business Arithmetic								
a. Decimals								
b. Accounts	31	1	3	-3	3	1.6	3	1.8
c. Partnership	31	1	3	-3	3	1.6	3	1.8
d. Partial Payments								
e. Case 3 in %								
f. Compound Interest								
g. Annual Interest								
h. True Discount								
Miscellaneous								
a. Counting	31	3	10	3-37	17	9.3	12	6.1
b. Square Root								
c. Cube Root								
d. Compound Numbers								
e. Mensuration	31	5	16	3-24	13	7.1	5	3

Grade V. The social utility curriculum requirements for Grade V necessitate drill time on addition, subtraction, multiplication and long division with the aim of perfect mastery.

An interpretation of Table VI will reveal that nineteen different processes are sharing the time which should be alloted to the four mentioned above. Less than half (49%) of the teachers reporting grant any drill time to addition and subtraction. 58.6 per cent report drill on multiplication and 68.9 on division.

The emphasis for this grade is upon fractions. 93.1 per cent of the teachers reporting allot drill time to common fractions, 86.2 to improper fractions, 65.5 to compound fractions, 79.3 to cancellation, and 65.5 to G.C.D. In addition to the large percentages of teachers reporting these processes, the mean time for this group is higher than for any other.

Tables and measures are well represented in this grade. 55.2 per cent of the teachers reporting are granting drill time to avoirdupois weight, and 25 per cent to longitude and time. There is one isolated case of Troy weight being taught, and two cases of the metric system being taught. It helps a little to note that these fifth grade teachers reporting the teaching of the metric system alloted but 3 and 14 hours per year, respectively, to the process. Both figures are far too high.

Two processes were reported under business arithmetic. Decimals were reported as being given drill by 58.6 per cent of the teachers replying to the questionnaire. 17 per cent were granting drill time to accounts. The percentage of teachers reporting drill on decimals begins in this grade, reaches its height in Grade VI, and dwindles rapidly in Grades VII and VIII.

Under miscellaneous, 20.7 per cent of all teachers reporting are giving drill time to mensuration. Isolated cases in counting and compound numbers were reported. Counting is reported in all grades from one to seven. A good and sufficient reason for this counting in the upper grades has not been forthcoming.

Table VI

Summarizing the Questionnaire Data for Grade V

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Process	No. Reporting for the Gr.	No. tchg. Partic. Process	Per cent Tchg. Process	Range in Hrs. per Yr.	Mean Time in Hrs. per Yr.	Col.6 reduced to per cent of Total	Median Time in Hrs. per Yr.	Col.8 reduced to per cent of Total
Fundamental Processes								
a. Addition	29	14	49	1-25	10.7	4.3	10	4.4
b. Subtraction	29	14	49	2-25	10.1	4	10	4.4
c. Multiplication	29	17	58.6	4-36	15.6	6.2	15	6.6
d. Division	29	20	68.9	4-90	21.9	8.7	16.5	7.2
Fractions								
a. Common	29	27	93.1	7-60	27.2	10.7	24	10.4
b. Improper	29	25	86.2	2-60	21.6	8.6	20	8.7
c. Compound	29	19	65.5	2-40	20.7	8.2	24	10.4
d. Cancellation	29	23	79.3	3-37	19.5	7.7	20	8.7
e. G.C.D.	29	19	65.5	2-36	16.1	6.4	12	5.2
Tables and Measures								
a. Avoirdupois Weight	29	16	55.2	2-40	11.6	4.7	4.5	1.9
b. Troy Weight	29	1	3.4	-18	18	7.2	18	7.9
c. Foreign Money								
d. Metric System	29	2	6.7	3-14	8.5	3.4	8.5	3.8
e. Longitude and Time	29	7	25.5	1-25	12	4.9	8	3.5
Business Arithmetic								
a. Decimals	29	17	58.6	5-30	18.5	7.3	20	8.7
b. Accounts	29	5	17.2	5-12	6.8	2.7	5	2.2
c. Partnership								
d. Partial Payments								
e. Case 3 in %								
f. Compound Interest								
g. Annual Interest								
h. True Discount								
Miscellaneous								
a. Counting	29	1	3.4	-2	2	.8	2	.9
b. Square Root								
c. Cube Root								
d. Compound Numbers	29	1	3.4	-1	1	.4	1	.5
e. Mensuration	29	6	20.7	4-24	11.7	4.7	11	4.8

Grade VI. The social utility curriculum requirements for Grade VI necessitate drill time upon the four fundamental processes and in addition to this, drill on simple fractions on an objective, nonmanipulative basis.

Table VII departs from this considerably. Twenty-five processes are reported as receiving drill. Examination reveals that only 33.4 per cent of the teachers reporting are giving any drill time to addition and subtraction and only 42.8 per cent to multiplication and division. This is a positive indication of the regrettable trend to omit drill on the fundamentals after Grade IV, and will be noted again in Grades VII and VIII.

Fractions, as a complete section, are reported by the highest percentage of teachers. (See table VII, pg. 43). More teachers indicated that they were drilling on decimals and avoirdupois weight (90.5% and 80.9%, respectively) than on any other individual processes. The extremities of the range in hours per year for decimals (3-100) is indicative of the extent to which some schools are accepting the social utility theory and also the extent to which some are still clinging to the traditional curriculum.

In this grade, a minor emphasis is placed upon Business Arithmetic. Each process is reported as being taught. This is a tendency first noted in Grade IV and which reaches its highest in Grade VII.

The two cases in counting are as unexplainable in this grade as in Grade V. Compound numbers are reported as being drilled upon by 28.6 per cent of the teachers reporting, and 38.1 per cent report drill time given to mensuration.

It is discouraging to note that the drill time is very limited for those processes which should be receiving the greater percentage of it. This is due to the fact that the available drill time has to be spread over twenty-five processes, many of which deserve little or none of it.

Wide studies on corrective load in the fundamentals 1/ indicate clearly that the drill emphasis in Grade VI should be on the fundamentals. From 85 per cent to 100 per cent of the pupils in this grade need such drill on the fundamentals, yet Table VII shows, in every column, that less time is spent on drill in the fundamentals (9.7 per cent, derived by adding the percentages of total time spent on addition, subtraction, multiplication and division, given in Column 7 of Table VII) than on drill in useless phases of fractions (29.6 per cent of total time, taken from Table XI, pg. 57), or useless phases of Business arithmetic (24.0 per cent, from Table XI, pg. 57). The percentages taken from Table XI are obtained by adding the percentages given for the respective processes listed under fractions and Business arithmetic for Grade VI.

1/ Hanley, Yarbrough, Nelson, Ringer, Houghton, Ridlon, Buckley (See Bibliography)

It may also be observed from Table VII that more time (2.9 per cent of total) is spent on the metric system than on any one fundamental process (2.3, 2.0, 2.6, and 2.8 per cent, respectively), and this in Grade VI, when we know that drill on the metric system has zero (0) value, and that too when a reasonable degree of mastery of the fundamentals has been obtained by less than 10 per cent of the pupils of this grade. Such a program is neither adapted to the needs of a child, nor designed to arouse his interest. It is a program of defeat, and should be treated as such. If the child is to be interested in his work, and thereby successful, the arithmetic drill curriculum as portrayed by Table VII must be drastically simplified and changed.

Table VII

Summarizing the Questionnaire Data for Grade VI

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Process	No. Reporting for the Gr.	No. Tchg. Partic. Process	Per cent Tchg. Process	Range in Hrs. per Yr.	Mean Time in Hrs. per Yr.	Col.6 reduced to per cent of Total	Median Time in Hrs. per Yr.	Col.8 reduced to per cent of Total
Fundamental Processes								
a. Addition	21	7	33.4	3-15	6.8	2.3	5	2.1
b. Subtraction	21	7	33.4	3-17	5.8	2	4	1.7
c. Multiplication	21	9	42.8	3-18	7.4	2.6	5	2.1
d. Division	21	9	42.8	3-19	8.1	2.8	8	3.3
Fractions								
a. Common	21	16	76.2	2-60	22.6	7.8	19.5	8.
b. Improper	21	15	71.4	2-60	20.8	7.2	11	4.5
c. Compound	21	10	47.6	2-37	17.9	6.2	17	7
d. Cancellation	21	14	66.7	2-60	26	9	30	12.3
e. G.C.D.	21	10	47.6	2-60	20.8	7.2	17	7
Tables and Measures								
a. Avoirdupois Weight	21	17	80.9	2-60	15.5	5.4	8	3.3
b. Troy Weight	21	4	19.1	2-25	6.8	2.3	3.5	1.5
c. Foreign Money	21	2	9.5	2-2	2	.7	2	.8
d. Metric System	21	2	9.5	3-14	8.5	2.9	8.5	3.5
e. Longitude and Time	21	8	38.1	1-30	11	3.8	6	2.5
Business Arithmetic								
a. Decimals	21	19	90.5	3-100	24.2	8.4	30	12.3
b. Accounts	21	7	33.4	3-18	7.7	2.7	5	2.1
c. Partnership	21	2	9.5	2-18	10	3.5	10	4.1
d. Partial Payments	21	1	4.8	-2	2	.7	2	.8
e. Case 3 in %	21	5	23.8	3-30	12.8	4.4	9	3.7
f. Compound Interest	21	2	9.5	5-18	11.5	4	11.5	4.7
g. Annual Interest	21	8	38.1	3-48	14.4	5	10	4.1
h. True Discount	21	7	33.4	2-40	10.8	3.7	4	1.7
Miscellaneous								
a. Counting	21	2	9.5	2-5	3.5	1.2	3.5	1.5
b. Square Root								
c. Cube Root								
d. Compound Numbers	21	6	28.6	1-15	8	8.6	8.5	3.5
e. Mensuration	21	8	38.1	3-15	7.8	2.7	7.8	2.9

Grade VII . The social utility curriculum for this grade is the reteaching of the fundamentals as needed, and the introduction of percentage and interest as the new process. (See Table VIII)

25 processes, or all included on the questionnaire with the exception of cube root and partnership, are reported as being taught.

The major emphasis in this grade is upon the useless phases of business arithmetic that were listed in the questionnaire. Annual interest is taught by the largest per cent (81.8%) of teachers reporting, but the greatest mean time is given to compound interest. Drill in interest should be confined to simple interest.

The fundamentals are taught by fewer teachers in this grade and the amount of time spent upon them is much less. 31.8 per cent of the teachers reporting give drill time to addition and subtraction, while 36.3 give drill time to multiplication and division.

The percentage of teachers giving drill time to fractions has fallen off perceptibly from that of Grade VI. The mean percentage of time for each process under fractions has not decreased however. This would seem to indicate that while fewer teachers are giving drill time to fractions, those who are, are giving more time to them.

The one case of 30 hours per year alloted to counting is totally unexplainable, either in terms of the Maine Course of Study, or of common sense. 22 per cent of the teach-

ers reporting for the grades are giving drill time to square root; 36.3 are drilling on compound numbers; and 32.7 per cent upon mensuration; 68.2 on true discount, a useless, purely theoretical process.

The drill load in this grade is far too great. Such a program is unwarranted and indefensible.

Table VIII

Summarizing the Questionnaire Data for Grade VII

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Process	No. Reporting for the Gr.	No. Tchg. Partic. Process	Per cent Tchg. Process	Range in Hrs. per Yr.	Mean Time in Hrs. per Yr.	Col.6 reduced to per cent of Total	Median Time in Hrs. per Yr.	Col.8 reduced to per cent of Total
Fundamental Processes								
a. Addition	22	7	31.8	2-15	6	2.3	5	2.5
b. Subtraction	22	7	31.8	2-17	6.3	2.4	5	2.5
c. Multiplication	22	8	36.3	2-18	6.9	2.6	5.5	2.7
d. Division	22	8	36.3	2-19	7	2.6	5.5	2.7
Fractions								
a. Common	22	9	40.9	3-30	9.7	3.6	8	3.9
b. Improper	22	9	40.9	3-30	8	3	4	2
c. Compound	22	2	9.1	3-12	7.5	2.8	7.5	3.7
d. Cancellation	22	7	31.8	2-45	14.4	5.4	5	2.5
e. G.C.D.	22	5	22.7	2-25	9	3.4	3	1.5
Tables and Measures								
a. Avoirdupois Weight	22	6	27.3	4-7	4.8	1.8	4.5	2.2
b. Troy Weight	22	4	18.2	1-20	7.3	2.7	4	2
c. Foreign Money	22	2	9.1	2-5	3.5	1.3	3.5	1.7
d. Metric System	22	7	31.8	5-18	7.4	2.8	5	2.5
e. Longitude and Time	22	7	31.8	4-18	6.6	2.5	5	2.5
Business Arithmetic								
a. Decimals	22	16	72.7	3-60	20.5	7.7	13.5	6.6
b. Accounts	22	17	77.3	2-36	11.1	4.2	10	4.9
c. Partial Payments	22	2	9.1	3-18	10.5	4	10.5	5.1
d. Partnership								
e. Case 3 in %	22	15	68.2	2-30	10.3	3.9	7	3.4
f. Compound Interest	22	9	40.9	2-72	27.6	10.4	18	8.8
g. Annual Interest	22	18	81.8	1-48	14.1	5.3	10	4.9
h. True Discount	22	15	68.2	2-40	13.3	5	10	4.9
Miscellaneous								
a. Counting	22	1	4.5	-30	30	11.3	30	14.7
b. Square Root	22	5	22.7	2-12	7	2.6	8	3.9
c. Cube Root								
d. Compound Numbers	22	8	36.3	1-15	7	2.6	8	3.9
e. Mensuration	22	6	32.7	3-60	10.7	4	10	4.9

Grade VIII. The social utility curriculum provided the same drill load for Grade VIII as for Grade VII. (See Table IX)

The section receiving the most emphasis is that of business arithmetic, as in Grade VII. In this section the greatest amount of time is given to case 3 in percentage which is closely followed by annual interest and true discount, all processes that are little used or useless.

Square root as an individual process was reported by a larger percentage of teachers than any other. 89.4 per cent of all teachers reporting gave drill time to this process. In life the ordinary citizen never uses this process. Another individual process which has a surprisingly large percentage of teachers reporting it is the Metric system. It is interesting to note that 52.6 per cent of the teachers reporting give drill time to the Metric System and but 31.6 per cent to addition and subtraction.

In this grade, every process has been checked by the reporting teachers as being taught with the exception of counting. This tendency for wide coverage may be explainable in view of the fact that many of the pupils in the rural districts of the state do not readily have access to secondary schools. Teachers who are aware of this condition make an attempt to crowd into the last year of the elementary school all the information which they feel the pupil should be equipped with in order to successfully obtain a livelihood.

An inspection of Tables VII and VIII reveals that the curriculum for the two grades are vastly similar. This

may be due to the fact that many teachers group Grades VII and VIII together and teach them identically the same material.

Two teachers report giving drill time to the teaching of cube root in the eighth grade. This, clearly, is an indication that there is still room for improvement in the construction of the drill curriculum. This is a process whose use in life is very limited, and justified no drill time whatsoever in the elementary schools.

Column 4 of Table IX reveals the following facts - that 89.4 per cent of all teachers reporting are giving drill on square root, 84.2 per cent on annual interest, 84.2 per cent on compound interest, 68.4 per cent on true discount, 63.2 per cent on mensuration, 63.2 per cent on case 3 in percentage, 52.6 per cent on metric system, 42.1 per cent on logitude and time and 42.1 per cent on decimals. In other words, these are the nine processes most taught by the teachers reporting, and they are giving a total of 75 per cent of their total time to these processes (from Column 7 of Table IX). All of these processes are relatively useless.

Only 16 per cent of the total time (from Column 7, Table IX) in Grade VIII is devoted to drill where drill should be, namely, on the fundamentals. Is it any wonder that the elementary teachers are condemned for not preparing these same pupils when the high school teacher receives them the next year? Would not a revision of this reported curriculum bring about a

decreased mortality in the first year of secondary schools? These are the questions which immediately come to mind when the facts are viewed.

Table IX

Summarizing the Questionnaire Data for Grade VIII

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Process	No. Reporting for the Gr.	No. Tchg. Partic. Process	Per cent Tchg. Process	Range in Hrs. per Yr.	Mean Time in Hrs. Per Yr.	Col.6 reduced to per cent of Total	Median Time in Hrs. per Yr.	Col.8 reduced to per cent of Total
Fundamental Processes								
a. Addition	19	6	31.6	2-18	6.2	3.2	5.5	3.5
b. Subtraction	19	6	31.6	2-15	6.3	3.3	5.5	3.5
c. Multiplication	19	7	36.8	2-28	8.7	4.5	5.5	3.5
d. Division	19	7	36.8	2-30	9	4.7	5.5	3.5
Fractions								
a. Common	19	6	31.6	2-12	7	3.6	6.5	4.1
b. Improper	19	7	36.8	2-12	5.4	2.8	4	2.5
c. Compound	19	3	15.7	3-12	6.7	3.4	5	3.2
d. Cancellation	19	6	31.6	3-12	6.2	3.2	5	3.2
e. G.C.D.	19	5	26.3	3-12	4.8	2.5	5	3.2
Tables and Measures								
a. Avoirdupois	19	3	15.7	2-7	5.4	2.8	5	3.2
b. Troy Weight	19	2	10.5	1-5	3	1.6	3	1.9
c. Foreign Money	19	4	21.1	2-18	6.8	3.5	3.5	2.2
d. Metric System	19	10	52.6	2-21	7.7	4	4.5	2.9
e. Longitude and Time	19	8	42.1	4-21	9.3	4.8	6.5	4.1
Business Arithmetic								
a. Decimals	19	8	42.1	2-33	10.9	5.7	10	6.3
b. Accounts	19	9	47.4	2-20	9.2	4.7	10	6.3
c. Partnership	19	5	26.3	2-10	4.6	2.4	3	1.9
d. Partial Payments	19	7	36.8	3-21	10	5.2	6	3.8
e. Case 3 in %	19	12	63.2	3-25	11.7	6	7.5	4.7
f. Compound Interest	19	16	84.2	3-25	9.8	5.1	8.5	5.4
g. Annual Interest	19	16	84.2	1-26	11.2	5.8	10	6.3
h. True Discount	19	13	68.4	3-20	11.3	5.9	10	6.3
Miscellaneous								
a. Counting								
b. Square Root	19	17	89.4	2-26	8.3	4.1	8	5.1
c. Cube Root	19	2	10.5	1-5	3	1.6	3	1.9
d. Compound Numbers	19	6	31.6	3-21	10.5	5.5	8	5.1
e. Mensuration	19	12	63.2	7-68	13.4	7.0	10	6.3

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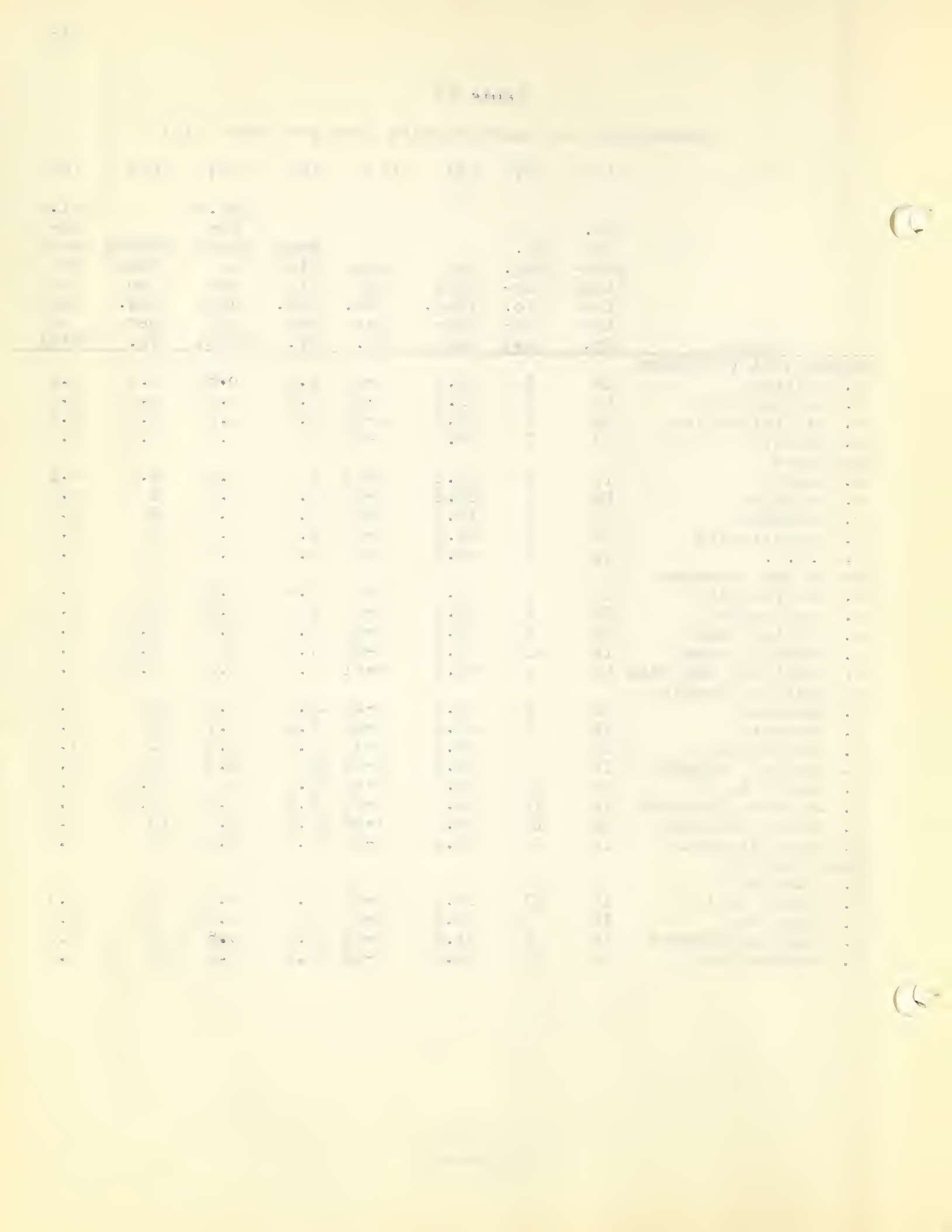

CHAPTER IV

SUMMARY

There is a need for finding out to what extent the social utility theory has infiltrated a defined geographical area. Actual practice always lags behind accepted theory. To discover the extent to which it is retarded in the state of Maine is the prime purpose of this study.

The study was conducted on the questionnaire basis. Questionnaires were sent to 100 teachers in the state, representing the largest cities and the smallest towns. These teachers were chosen by a random sampling carried out by the Maine State Department of Education.

78 per cent of the questionnaires were returned. This high percentage of returns indicates a high degree of interest in the study. The questionnaire was a little complicated and the amount of time and study expended for cooperation in answering the questionnaire is appreciated.

The information received from the returned questionnaires seems to indicate that the major emphasis in each of the grades is as follows: Grades I and II, addition and subtraction; Grades III and IV, multiplication and division; Grades V and VI, useless phases of fractions, decimals, and business arithmetic; Grades VII and VIII, business arithmetic.

It is also to be noted from the returns that a great amount of the total available drill time is spent on other less socially useful processes to the exclusion of the above mentioned, i.e., (from Table XI, pg. 57) in Grade VIII, 78.7 per cent of the available drill time in arithmetic is given to socially useless processes, in Grade VII, 67.6 per cent; in Grade VI, 80.0 per cent; etc. It is interesting to note that 11.7 per cent of the available drill time in Grade VII is being given to useless manipulation of fractions; and that 16.7 per cent in the same grade is being given to useless drill in Tables and Measures. These latter figures were obtained by adding the percents of time given for the processes listed under Fractions and Tables and Measures in Table XI.

Tables X and XII have been constructed as a means of summarizing the data for all the grades. Table X is based upon the Mean, and Table XII upon the Median. Table X is to be interpreted as follows: In grade I, 18.9 per cent of all the time which is given to drill in arithmetic is spent upon addition. Similarly, only 3.5 per cent of the entire amount of time given to drill in arithmetic in Grade VIII is spent upon addition. Table XII, based upon the Median, is to be read in a similar manner. Table XI has been constructed as a summary form of Table X.

Table X

Percent of Time Per Process for Each Grade#

Process	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6	Gr.7	Gr.8
Fundamental Processes								
a. Addition	18.9	25.2	14.1	11.0	4.3	2.3	2.3	3.5
b. Subtraction	18.6	25.3	14.1	14.2	4.0	2.0	2.4	3.3
c. Multiplication	19.7	20.2	19.0	20.9	6.2	2.6	2.6	4.5
d. Division	5.4	19.0	16.4	23.7	8.7	2.8	2.6	4.7
Fractions								
a. Common	5.4		3.1	3.3	10.7	7.8	3.6	3.6
b. Improper				2.2	8.6	7.2	3.0	2.8
c. Compound					8.2	6.2	2.8	3.4
d. Cancellation				1.6	7.7	9.0	5.4	3.2
e. G.C.D.					6.4	7.2	3.4	2.5
Tables and Measures								
a. Avoirdupois Weight	6.7		4.5	3.6	4.7	5.4	1.8	2.8
b. Troy Weight				1.1	7.2	2.3	2.7	1.6
c. Foreign Money						.7	1.3	3.5
d. Metric System					3.4	2.9	2.8	4.0
e. Longitude and Time	5.4	1.7	4.5	1.3	4.9	3.8	2.5	4.8
Business Arithmetic								
a. Decimals					7.3	8.4	7.7	5.7
b. Accounts				1.6	2.7	2.7	4.2	4.7
c. Partnership				1.6		3.5		2.4
d. Partial Payments						.7	4.0	5.2
e. Case 3 in %						4.4	3.9	6.0
f. Compound Interest						4.0	10.4	5.1
g. Annual Interest						5.0	5.3	5.8
h. True Discount						3.7	5.0	5.9
Miscellaneous								
a. Counting	9.1	6.4	3.5	9.3	.8	1.2	11.3	
b. Square Root							2.6	4.1
c. Cube Root								1.6
d. Compound Numbers					.4	8.6	2.6	4.1
e. Mensuration	2.3	2.1	4.8	7.1	4.7	2.7	4.0	5.2

(based on Mean)

Table XI has been constructed as a summary of Table X. Each process included in Table XI has been condemned, in terms of adult usage, as useless. 1/ If the results of the many studies made on this point are confirmatory of each other, it seems unreasonable to ask grade children to spend time in mastering them. 2/

An examination of Table XI will show how badly we, in the school systems of Maine, are blundering. When the columns for each grade are totalled, it is revealed that 80 per cent of the time allotted to drill in arithmetic in Grade VI is given to drill on useless processes. This grade is not alone in the discrepancy, for the percent of time given to drill on useless processes in Grade VII totals 67.6, and similarly for Grade VIII, 78.7.

It is not recommended that all of the processes listed in Table XI be eliminated from the arithmetic curriculum. They should be eliminated from the drill program, however, and presented to the pupils on an appreciation basis only. What can be done in this matter is largely dependent upon the skill and enthusiasm of the teacher. The use of square root is very limited in life, but this process, as well as others listed in

1/ Wilson, Guy M., What Arithmetic Shall We Teach, Houghton Mifflin Co., 1939.
2/ Wilson, Wise, Woody, Charters, Noon, Smith, Hansen, Babbitt.

Table XI, can be manipulated successfully by the brighter pupils with no detrimental effects and possibly with beneficial results. The social utility concept would not discard these processes, but would retain them as a means of keeping idle hands out of mischief, and affording an opportunity for those who are interested, to play with the mechanics of mathematics on an optional basis. No assignment of home work should include any process listed in Table XI.

Table XI

Process	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6	Gr.7	Gr.8
Fundamental Processes								
a.								
b.								
c.								
d.								
Fractions								
a.								
b. Improper				2.2	8.6	7.2	3.0	2.8
c. Compound					8.2	6.2	2.8	3.4
d. Cancellation				1.6	7.7	9.0	5.4	3.2
e. G.C.D.					6.4	7.2	3.4	2.5
Totals				3.8	30.9	29.6	14.6	11.9
Tables and Measures								
a. Avoirdupois Weight	6.7		4.5	3.6	4.7	5.4	1.8	2.8
b. Troy Weight				1.1	7.2	2.3	2.7	1.6
c. Foreign Money						.7	1.3	3.5
d. Metric System					3.4	2.9	2.8	4.0
e. Longitude and Time	5.4	1.7	4.5	1.3	4.9	3.8	2.5	4.8
Totals	12.1	1.7	9.0	6.0	20.2	15.1	11.1	16.7
Business Arithmetic								
a.								
b. Accounts				1.6	2.7	2.7	4.2	4.7
c. Partial Payments						.7	4.0	5.2
d. Partnership				1.6		3.5		2.4
e. Case 3 in %						4.4	3.9	6.0
f. Compound Interest						4.0	10.4	5.1
g. Annual Interest						5.0	5.3	5.8
h. True Discount						3.7	5.0	5.9
Totals				3.2	2.7	24.0	32.8	35.1
Miscellaneous								
a.								
b. Square Root							2.6	4.1
c. Cube Root								1.6
d. Compound Numbers					.4	8.6	2.6	4.1
e. Mensuration	2.3	2.1	4.8	7.1	4.7	2.7	4.0	5.2
Totals	2.3	2.1	4.8	7.1	5.1	11.3	9.2	15.0
GRAND TOTALS	14.4	3.8	13.8	20.1	58.9	80.0	67.7	78.7

Table XII

Percent of Time per Process for Each Grade#

Process	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6	Gr.7	Gr.8
Fundamental Processes								
a. Addition	24.6	26.4	19.7	12.1	4.4	2.1	2.5	3.5
b. Subtraction	24.6	24.9	19.7	16.4	4.4	1.7	2.5	3.5
c. Multiplication	16.6	17.8	21.3	21.8	7.2	3.3	2.7	3.5
d. Division	7.4	19.8	18.4	21.8	6.6	2.1	2.7	3.5
Fractions								
a. Common			3.9	4.9	10.4	8	3.9	4.1
b. Improper				2.4	8.7	4.5	2	2.5
c. Compound					10.4	7	3.7	3.2
d. Cancellation				1.8	8.7	12.3	2.5	3.2
e. G.C.D.					5.2	7	1.5	3.2
Tables and Measures								
a. Avoirdupois Weight	9.2		5	2.4	1.9	3.3	2.2	3.2
b. Troy Weight				1.2	7.9	1.5	2	1.9
c. Foreign Money						.8	1.7	2.2
d. Metric System					3.8	3.5	2.5	2.9
e. Longitude and Time	7.4	1.8	3	1.6	3.5	2.5	2.5	4.1
Business Arithmetic								
a. Decimals					8.7	12.3	6.6	6.3
b. Accounts				1.8	2.2	2.1	4.9	6.3
c. Partnership				1.8		4.1		1.9
d. Partial Payments						.8	5.1	3.8
e. Case 3 in %						3.7	3.4	4.7
f. Compound Interest						4.7	8.8	5.4
g. Annual Interest						4.1	4.9	6.3
h. True Discount						1.7	4.9	6.3
Miscellaneous								
a. Counting	7.4	5.5	5.9	6.1	.9	1.5	14.7	
b. Square Root							3.9	5.1
c. Cube Root								1.9
d. Compound Numbers					.5	3.5	3.9	5.1
e. Mensuration	3.1	2.2	6.8	3	4.8	2.9	4.9	6.3

(based on Median)

CHAPTER V

CONCLUSIONS

From Tables X and XI we may justly conclude:

A. That too much time is being spent drilling on the fundamental processes in Grades I and II to the exclusion of informational arithmetic. Such time is worse than wasted.

It is evident that the lower grades still adhere quite closely to the traditional arithmetic curriculum, i.e., more than 60 per cent of the arithmetic time in Grade I is spent on drill in the four fundamental processes, and in Grade II - 90 per cent. This program is scarcely defensible in terms of the social utility viewpoint 1/ or in common practice in the more progressive schools. In these grades informed work should replace drill.

B. That the drill load reported for Grades III and IV is too heavy. Too many processes constitutes a program of confusion and defeat.

Where the social utility curriculum advocates one, or possibly two, drill processes for Grade III, 2/ nine are reported. Likewise, in Grade IV three or possibly four drill

1/ See page 26.
2/ Ibid

processes are advocated by the social utility curriculum 1/ and fourteen are reported. This unwise distribution of drill load naturally leads children to dislike arithmetic.

C. That more of the available drill time is being devoted to dominant drill in fractions, decimals, measures, and useless processes than common usage warrants than to much needed drill on the fundamentals.

D. That in Grades V thru VIII, from 58.9 to 80.0 per cent (see Table XI) of the total drill time is being given to drill on useless processes, at the expense of much needed drill and review on the useful processes. (See page 57).

Grade IV evidently serves as a terminal point for the study of the fundamental processes in most schools. We find small time allotments to the fundamentals in all grades beyond this point; specifically, Grades VI and VII spend less than 10 per cent of their available drill time on the fundamentals, Grade VIII less than 17 per cent and Grade V less than 24 per cent. These processes, having the highest percentages of adult usage, deserve more drill time, in view of studies indicating a small percentage of mastery of the fundamentals in these grades (9% to 19%.)2/

1/ Ibid, page
2/ Nelson, Helen G., "Corrective Load in Arithmetic in a Jr. High School," B.U. Sch. of Educ. Thesis, Ed.M., 1938, pg.

Buckley, Frederick A., "What Need is there for a Corrective Arithmetic Program for Pupils in the Four Courses of a Senior High School and What Progress is it Possible to Achieve Through Group Instruction in a Limited Time?" B.U. Sch. of Educ., Ed.M. Thesis, 1940, pg. .

In comparison to the above stated figures, note (from Table XI) that 24.0 per cent of the available drill time in Grade VI is being given to useless business processes, as are 32.8 per cent of the available drill time in Grade VII, and 35.1 per cent of the available drill time in Grade VIII. This is to cite but a few of the many interesting facts and comparisons which can be drawn from careful study of Tables X and XI.

CHAPTER VI

OTHER STUDIES SUGGESTED

A. In Table VIII it is to be noted that in one case a relatively high percentage of time is being alloted in Grade VII to counting. This is unexplainable both in terms of the Maine course of study and reason. Therefore, it is suggested that further study be made on this point and similar ones as are to be noted in Tables II and III where we find avoirdupois weight and mensuration being taught in the first two grades.

B. As this Maine Study has revealed most interesting discrepancies between actual practice and acceptable theory, it is suggested that similar surveys be made in other states whose departments of education are acutely aware of their task as efficient supervisors.

C. Teachers within their own town, district or county, might take account of stock to see how closely they, in their eagerness to provide vital education, are offering socially useful material to their future citizens. This study, or an extension of the same, might profitably be reported in various counties or various cities of the state.

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APPENDIX

Specific Sources of Data

The following cities and towns replied to the questionnaire

Alfred
Amherst
Ashland
Bangor
Belfast
Berwick
Bethel
Biddeford
Bingham
Blaine
Boothbay
Boothbay Harbor
Brewer
Bridgton
Brooks
Brunswick
Bucksport
Caribou
Cornish
Corinna
Damariscotta
Danforth
Dixfield
Dover-Foxcroft
Eastport
Ellesworth
Fairfield
Farmington
Franklin
Freeport
Fryeburg
Ft. Fairfield
Ft. Kent
Gorham
Greenville
Guilford
Hancock
Harrington
Hartland
Houlton
Island Falls
Lewiston
Lincoln
Livermore Falls
Lubec
Machias
Machiasport
Mars Hill
Milford
Millinocket
Mill Town
Milo
Monson
Mount Desert
Newport
Norway
Oakland
Old Town
Phillips
Pittsfield
Portland
Presque Isle
Rangeley
Readfield
Rockland
Sanford
Scarborough
Seal Harbor
Somesville
South Paris
South Portland
Temple
Vinalhaven
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